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NATIONAL DAM INSPECTION PROGRAM. CLEAR LAKE DAM (NDI ID NUMBER --ETC(U)
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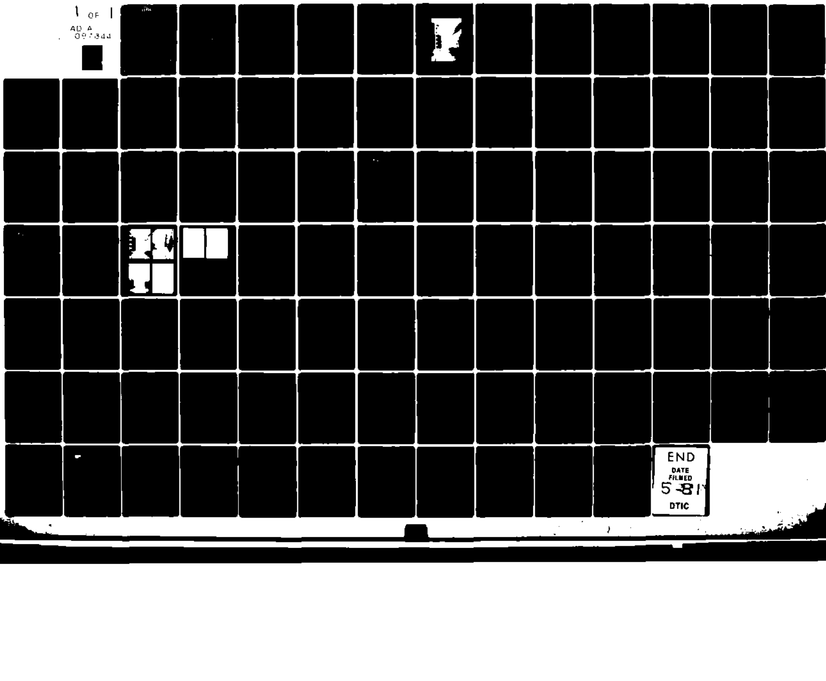

LEVEL

OHIO RIVER BASIN
EAST BRANCH OIL CREEK, CRAWFORD COUNTY

PENNSYLVANIA

CLEAR LAKE DAM

NDI ID NO. PA-175
DER ID NO. 20-3

WILLIAM MORTON

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DACW31-81-C-0012

Prepared By
L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG, PENNSYLVANIA
15931

FOR

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS
BALTIMORE, MARYLAND
21203

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MARCH 1981

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in detemining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT
NATIONAL DAM INSPECTION REPORT

NAME OF DAM	Clear Lake Dam
STATE LOCATED	Pennsylvania
COUNTY LOCATED	Crawford
STREAM	East Branch Oil Creek
DATES OF INSPECTION	October 20, 1980 and January 15, 1981
COORDINATES	Lat: 41° 49.5' Long: 79° 40.5'

ASSESSMENT

The assessment of Clear Lake Dam is based upon visual observations made at the time of inspection, review of available information, hydraulic and hydrologic computations, stability analysis computations and past operational performance. The inspection and review of data of the Clear Lake Dam did not reveal any problems which require emergency action. The dam appears to be in poor condition and poorly maintained.

The Clear Lake Dam is a high hazard-small size dam. The spillway design flood (SDF) for a dam of this size and classification is in the range of the 1/2 PMF to the PMF. The PMF has been selected as the spillway design flood based on the downstream potential for loss of life. The spillway and reservoir are capable of controlling approximately 6% of the PMF. Based on criteria established by the Corps of Engineers, the spillway is termed seriously inadequate. Clear Lake Dam is classified as an unsafe non-emergency dam.

The following recommendations and remedial measures should be instituted immediately.

1. A detailed stability and seepage analysis should be conducted by a registered professional engineer knowledgeable in dam design and construction and should be conducted in conjunction with a hydrologic and hydraulic analysis of the structure to increase spillway capacity and the stability of the structure.

2. The method used to block the penstock should be investigated by a registered professional engineer knowledgeable in dam design and construction. Repairs should be conducted accordingly.

3. A method to drain the reservoir should be prepared.

4. The debris in the spillway near the left abutment should be removed.

CLEAR LAKE DAM
PA 175

5. A regularly scheduled operations and maintenance program should be prepared and implemented at the dam.

6. A warning system should be developed to warn downstream residents of large spillway discharges or imminent failure of the dam.

7. A safety inspection program should be implemented with inspection at regular intervals by qualified personnel.

SUBMITTED BY:

COMMONWEALTH
Registered
PROFESSIONAL
R. JEFF...

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS AND ARCHITECTS

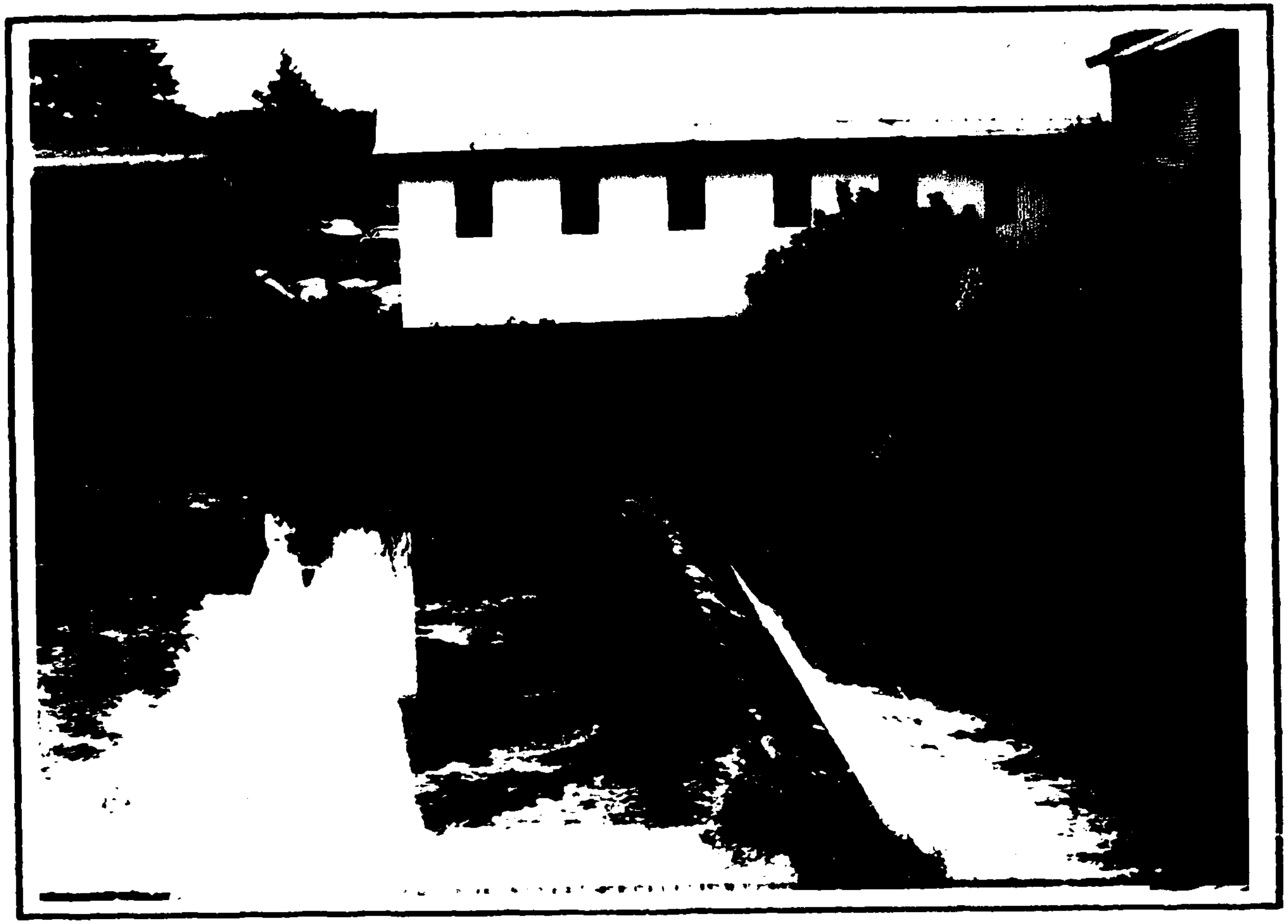
FEB 25 1981
Date

R. Jeffrey Kimball, P.E.

APPROVED BY:

27 MAR 81
Date

JAMES W. PECK
COL, Corps of Engineers
District Engineer



Overview of Clear Lake Dam

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APPENDICES

PHASE I
NATIONAL DAM INSPECTION PROGRAM

CLEAR LAKE DAM
NDI. I.D. NO. PA 175
DER I.D. NO. 20-3

SECTION 1
PROJECT INFORMATION

1.1 General.

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Clear Lake Dam is a concrete gravity dam, 130 feet long and 11 feet high. The right edge of the gravity section abuts natural ground and is formed by a concrete non-overflow section. A vertical concrete retaining wall exists at the left abutment and adjoins an existing sawmill. An abandoned and deteriorating penstock is located at the base of the retaining wall at the left abutment. Approximately 32 feet beyond the retaining wall at the left abutment exists an abandoned powerhouse.

b. Location. The dam is located in the Borough of Spartansburg, Crawford County, Pennsylvania. The Clear Lake Dam can be located on the Spartansburg, U.S.G.S. 7.5 minute quadrangle.

c. Size Classification. Clear Lake Dam is a small size dam (11 feet high, 782 acre-feet).

d. Hazard Classification. Clear Lake Dam is a high hazard dam. Downstream conditions indicate that the loss of more than a few lives is probable should the structure fail. One home is located approximately 1.2 miles downstream of the dam.

e. Ownership. Clear Lake Dam is owned by Mr. William Morton. Correspondence should be addressed to:

Mr. William Morton
Box 48
Spartansburg, PA 16434
814/654-7814

f. Purpose of Dam. Clear Lake Dam is used for recreation.

g. Design and Construction History. No information relative to the design and construction of Clear Lake Dam exists in the PennDER files. Information contained in the National Inventory of Dams indicates that the dam was completed in 1855 and that the engineering for the dam was completed by George F. Wieghardt. Other information contained in the inventory indicates that the dam was rebuilt in 1902. It is unclear whether the water power was included in the original design or added later during the 1902 modifications.

h. Normal Operating Procedures. No operating procedures exist for the dam.

1.3 Pertinent Data.

a. Drainage Area. 12.91 square miles

b. Discharge at Dam Site (cfs).

Maximum known flood at dam site	Unknown
Drainline capacity at normal pool	None
Spillway capacity at top of dam	1410

c. Elevation (U.S.G.S. Datum) (feet). - Field survey based on pool elevation 1441.0 feet of pain from U.S.G.S. 7.5 minute quadrangle.

Top of dam - low point	1443.6
Top of dam - design height	Unknown
Normal pool	1441.0
Spillway crest	1441.0
Upstream portal - penstock	Unknown
Downstream portal - penstock	1433.7
Normal tailwater	1432.8
Toe of dam	1432.8

d. Reservoir (feet).

Length of maximum pool (PMF)	9000
Length of normal pool	5000

e. Storage (acre-feet).

Normal pool	393
Top of dam	782

f. Reservoir Surface (acres).

Top of dam	200
Normal pool	118
Spillway crest	118

g. Dam.

Type	Concrete gravity
Length	130 feet
Height	11 feet
Top width	6 feet
Side slopes - upstream	Vertical
- downstream	Vertical
Zoning	None
Impervious core	Gravity section
Cutoff	Unknown
Grout curtain	None

h. Reservoir Drain.(None)

i. Spillway.

Type	Concrete gravity
Length	102 feet
Upstream channel	Lake (unrestricted)
Downstream channel	Natural stream

SECTION 2
ENGINEERING DATA

2.1 Design. No information is available relative to the design of the dam. Information contained in the National Inventory of Dams indicate that the dam was engineered by George Wieghardt.

2.2 Construction. No information relative to the construction of the Clear Lake Dam was available for review. Information contained in the National Inventory of Dams indicates that the dam was completed in 1855 and was modified in 1902. No information relative to the modifications was available for review.

2.3 Operation. No operations are conducted at the dam.

2.4 Evaluation.

a. Availability. No engineering design or construction data were available for review. Information contained in the National Inventory of Dams was reviewed for the purposes of this report.

b. Adequacy. This Phase I Report is based on the visual inspection and hydrologic and hydraulic analysis. Sufficient information exists to complete a Phase I Report.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The onsite inspection of Clear Lake Dam was conducted by personnel of L. Robert Kimball and Associates and a representative of the Pennsylvania Department of Environmental Resources on October 20, 1980. Representatives of L. Robert Kimball and Associates again inspected the dam on January 15, 1981. The inspection consisted of:

1. Visual inspection of the retaining structure, abutments and toe.
2. Examination of the spillway facilities, exposed portion of any outlet works and other appurtenant works.
3. Observations affecting the runoff potential of the drainage basin.
4. Evaluation of the downstream area hazard potential.

b. Dam. The dam appears to be in poor condition. The exposed portions of the concrete gravity section showed visible signs of deterioration. Cracks were observed along the crest of the dam and on the apron. Possible undercutting of the apron exists, although discharges over the spillway hampered attempts at close inspection of the apron. Random fill material exists near the left abutment of the dam and some of the material is beginning to protrude beyond the left wall of the spillway structure. Some seepage was visible underneath the left spillway wall and adjacent retaining wall.

c. Appurtenant Structures. The intake structure for the abandoned penstock was located at the left abutment at the structure. The intake structure was abandoned at some unknown date and the entrance to the power intake structure was filled with random material to block the entrance to the structure. A hole was observed on the surface of the ground at the left abutment of the dam. A close inspection of the hole showed that a cavity existed beneath the surface in the area. It appears as though some of the material used to block the intake for the power unit has eroded away thus producing the cavity. The abandoned penstock is in a deteriorated condition and a portion of the pipe has completely rusted through.

d. Reservoir Area. The watershed consists almost equally of forested land as well as farmland. The watershed slopes are moderate to steep and the reservoir slopes are gentle to moderate and do not appear to be susceptible to massive landslides which would affect the storage volume of the reservoir or cause overtopping of the dam by displacing water. No obstructions are known to exist in the watershed area which would affect the inflow to the reservoir.

e. Downstream Channel. The downstream channel of the Clear Lake Dam is relatively narrow and consists of the East Branch of Oil Creek. One home (approximately 4 people) exists 1.2 miles downstream of the dam.

3.2 Evaluation. The concrete gravity dam appeared to be in poor condition and poorly maintained. The concrete gravity section as well as the concrete abutments show visible signs of deterioration. The concrete apron is cracking and the possibility of undercutting exists. Seepage was observed near the left abutment and a cavity exists behind the retaining wall at the left abutment. The abandoned water power works is in a deteriorating condition but no seepage was observed flowing through the abandoned penstock.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures. The waterlevel is maintained at the spillway crest elevation, 1441.0.

4.2 Maintenance of the Dam. No planned maintenance schedule exists for the Clear Lake Dam. It was reported by the owner, Mr. William Morton, that a past history of seepage existed at the dam. Mr. Morton reported that attempts to reduce the seepage included the placement of additional concrete on the upstream face of the dam several years ago.

4.3 Maintenance of Operating Facilities. No date was associated with the abandonment of the power facilities at the dam. No maintenance had been provided for the power facilities since the facilities were abandoned.

4.4 Warning System in Effect. No known warning system exists for the dam.

4.5 Evaluation. The condition of the dam is considered poor. There is no regularly scheduled maintenance program for the dam. The abandoned power facilities are in a deteriorated condition and seepage was observed exiting in the area of the observed cavity at the left abutment.

There is no warning system in effect at the dam. An emergency action plan should be available for every dam in the high and significant category. Such plans should outline actions to be taken by the operator to minimize downstream effects of an emergency and should include an effective warning system.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features.

a. Design Data. There were no hydrologic or hydraulic design calculations available for review regarding the dam.

b. Experience Data. No rainfall, runoff or reservoir level data were available. The spillway reportedly has functioned adequately in the past.

c. Visual Observations. The spillway gravity section appeared to be in poor condition and poorly maintained. Random fill material was observed at the left abutment and portions of the fill material protrude beyond the left spillway wall. The area beyond either abutment appeared to consist of natural ground. An abandoned railroad tressel exists upstream of the spillway approach but did not appear capable of affecting the discharge potential of the spillway.

d. Overtopping Potential. Overtopping potential was investigated through the development of the probable maximum flood (PMF) for the watershed and the subsequent routing of the PMF and fractions of the PMF through the reservoir and spillway.

The Corps of Engineers, Baltimore District, has directed that the HEC-1 Dam Safety Version systemized computer program be utilized. The program was prepared by the Hydrologic Engineering Center (HEC), U.S. Army Corps of Engineers, Davis, California, July, 1978. The major methodologies or key input data for this program are discussed briefly in Appendix D.

5.2 Evaluation Assumptions. To enable completion of the hydraulic and hydrologic analysis for this structure, it was necessary to make the following assumptions.

1. Pool elevation prior to the storm was at the spillway crest elevation, 1441.0

2. The abandoned railway tressel upstream of the spillway approach was not considered as having an affect on the discharge potential of the spillway.

3. The area of fill at the left abutment which protruded past the left spillway wall was not considered as affecting the discharge potential of the spillway.

4. The top of dam was considered to be the average elevation on the top of the retaining wall at the left abutment.

5.3 Summary of Overtopping Analysis. Complete summary sheets for the computer output are presented in Appendix D.

Peak inflow (PMF)	31000 cfs
Spillway capacity	1410 cfs

a. Spillway Adequacy Rating. The Spillway Design Flood (SDF) for a dam of this size and classification is in the range of 1/2 PMF to PMF. The spillway design flood for this dam was selected to be the PMF based on the downstream potential for loss of life. Based on the following definition provided by the Corps of Engineers, the spillway is rated as seriously inadequate as a result of our hydrologic analysis. The spillway and reservoir are capable of controlling approximately 6% of the PMF without overtopping the abutments.

Seriously inadequate - All high hazard dams not capable of passing 50% of the Spillway Design Flood (PMF) and where there is significant increase in the hazard potential for loss of life due to dam failure.

The spillway and abutments appear to be capable of sustaining overtopping above the stated top of dam elevation for a limited depth and duration without causing failure at the abutments due to erosion. Subsequent calculations relative to the stability of the gravity section appear in Appendix G of this report. The review of the calculations indicate that the dam would experience a sliding failure at or below 50% of the PMF.

5.4 Summary of Dam Breach Analysis. As the subject dam is not capable of satisfactorily passing 50% of the PMF (based on our analysis) is was necessary to perform a dam breach analysis and downstream routing of the flood wave. This analysis determined the degree of increased flooding due to dam failure.

A reservoir pool elevation of 1449.4 was considered as sufficient to cause failure of the gravity section. This elevation represents a pool elevation associated with a 1/2 PMF event and was the elevation considered in the stability analysis which ultimately indicated the structure was unstable due to the potential for a sliding failure (see Appendix G).

The flood wave was routed downstream with and without failure considerations. The downstream potential for loss of life and property damage is significantly increased by dam failure. The potential for increased flooding downstream is significant based on the calculated instability of the structure and the potential flood wave assocaited with such a failure. Therefore, the spillway is rated as seriously inadequate and the facility is classified as unsafe, non-emergency.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. The Clear Lake Dam appeared to be in poor condition and poorly maintained. The concrete gravity section showed visible signs of deterioration and cracking. Cracks were observed on the concrete apron and the possibility of undercutting of the apron exists although close inspection of the structure was hampered due to flow over the spillway. Seepage was observed at the left abutment of the structure and a cavity was observed on the left abutment upstream of the retaining wall and adjacent to the left spillway wall. The observed cavity at the left abutment was 5 to 6 feet deep and at least several feet in width. The cavity is in the area of the abandoned intake structure for the powerhouse penstock. The penstock is in a deteriorating condition and holes have rusted through sections of the penstock.

b. Design and Construction Data. No design or construction data were available for review.

c. Operating Records. No operations are conducted at the dam.

d. Post Construction Changes. Based on information obtained from the National Inventory of Dams it appears as though possible modifications to the structure occurred in 1902. Information in the inventory lists the dam as being rebuilt in 1902. No other information relative to the possible modifications or rebuilding of the dam were available for review.

e. Seismic Stability. The dam is located in seismic zone 1. No seismic stability analysis has been performed. Normally, it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake loading. Based on the results of the stability analysis contained in Appendix G a sufficient factor of safety under static loading conditions may be less than a minimum acceptable value. A more detailed stability analysis should be conducted. Upon completion of the stability analysis an evaluation of the seismic stability should be conducted.

f. Stability Analysis. Calculations regarding the structural stability of the gravity section appear in Appendix G of this report. The results of the analysis indicate that the gravity section is unstable for discharges associated with the occurrence of a 1/2 PMF event. Calculations in Appendix G indicate a factor of safety of 0.45 with regards to a sliding failure. A factor of 0.45 with regards to a sliding failure is significantly less than the recommended minimum accepted values.

SECTION 7

ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The dam appears to be in poor condition and poorly maintained. Some seepage was observed near the left abutment of the spillway section. A cavity was observed on the upstream end of a retaining wall located at the left abutment. The cavity was observed to be in the area of the abandoned intake structure for the powerhouse penstock. The area was reported filled with random material at some time in the past. The existence of the cavity is a possible indication of erosion of the material behind the wall due to seepage in the area. The existing abandoned power facilities are in a deteriorating condition. The penstock is rusting and holes exist in the penstock near the bottom of the pipe. Clear Lake Dam is classified as unsafe, non-emergency.

The concrete gravity section has several cracks near the crest. The concrete is visibly deteriorating as is the concrete apron. Cracks were observed in the concrete apron and the possibility of the undercutting of the structure exists although attempts to examine the section were hampered due to flow over the spillway section.

b. Adeqacy of Information. Sufficient information is available to complete a Phase I Report.

c. Urgency. The recommendations suggested below should be implemented immediately.

d. Necessity for Further Investigation. Based on the visible deficiencies noted during the inspection, the hydrologic and hydraulic analysis and the stability analysis, it is recommended that further investigations be conducted.

7.2 Recommendations/Remedial Measures.

1. A detailed stability and seepage analysis should be conducted by a registered professional engineer knowledgeable in dam design and construction and should be conducted in conjunction with a hydrologic and hydraulic analysis of the structure to increase spillway capacity and the stability of the structure.

2. The method used to block the penstock should be investigated by a registered professional engineer knowledgeable in dam design and construction. Repairs should be conducted accordingly.

3. A method to drain the reservoir should be prepared.

4. The debris in the spillway near the left abutment should be removed.

5. A regularly scheduled operations and maintenance program should be prepared and implemented at the dam.

6. A warning system should be developed to warn downstream residents of large spillway discharges or imminent failure of the dam.

7. A safety inspection program should be implemented with inspection at regular intervals by qualified personnel.

APPENDIX A

CHECKLIST, VISUAL INSPECTION, PHASE I

CHECK LIST
VISUAL INSPECTION
PHASE I

NAME OF DAM Clear Lake Dam COUNTY Crawford STATE Pennsylvania ID# PA 175

TYPE OF DAM Concrete gravity HAZARD CATEGORY High

DATE(s) INSPECTION October 20, 1980 / January 15, 1981 WEATHER Clear and cold TEMPERATURE 40° / 20°

POOL ELEVATION AT TIME OF INSPECTION 1441.0 M.S.L. TAILWATER AT TIME OF INSPECTION 1433.2 M.S.L.

INSPECTION PERSONNEL:

R. Jeffrey Kimball, P.E. - L. Robert Kimball and Associates

James T. Hockensmith - L. Robert Kimball and Associates

O.T. McConnell - L. Robert Kimball and Associates

Chuck Woodward - Pennsylvania Department of Environmental Resources

O.T. McConnell RECORDER

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	Not applicable.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	Not applicable.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Not applicable.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Not applicable.	
RIPRAP FAILURES	Not applicable.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VEGETATION	Not applicable.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Not applicable.	
ANY NOTICEABLE SEEPAGE	Not applicable.	
STAFF GAUGE AND RECORDER	Not applicable.	
DRAINS	Not applicable.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	Seepage observed at the left abutment adjacent to the left spillway wingwall.	The seepage is exiting from an area where an original intake structure for a power facility existed.
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Showed no visible signs of stress.	
DRAINS	None.	
WATER PASSAGES	Intake structure to abandoned penstock backfilled.	A visible cavity existed at the entrance to the abandoned power facility.
FOUNDATION	No visible deficiencies observed.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Surface cracks exists on the concrete gravity section and on the apron. Potential undercutting of the gravity section exists. Close inspection of the structure was hampered due to flow over the spillway.	
STRUCTURAL CRACKING	No vertical cracks were observed in the gravity section although flow over the section hampered attempts to view the entire face of the structure. Visible cracks in the apron were observed and their locations appear on A-12.	
VERTICAL AND HORIZONTAL ALIGNMENT	Appear all right.	
MONOLITH JOINTS	Appear all right	
CONSTRUCTION JOINTS	None visible.	
STAFF GAUGE OR RECORDER	None.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Not applicable.	
INTAKE STRUCTURE	Not applicable.	
OUTLET STRUCTURE	Not applicable.	
OUTLET CHANNEL	Not applicable.	
EMERGENCY GATE	Not applicable.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Semi-broad crest. Entire concrete section serves as a spillway.	
APPROACH CHANNEL	Unrestricted - lake.	
DISCHARGE CHANNEL	Natural stream.	
BRIDGE AND PIERS	None.	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Not applicable.	
APPROACH CHANNEL	Not applicable.	
DISCHARGE CHANNEL	Not applicable.	
BRIDGE AND PIERS	Not applicable.	
GATES AND OPERATION EQUIPMENT	Not applicable.	

DOWNSTREAM CHANNEL

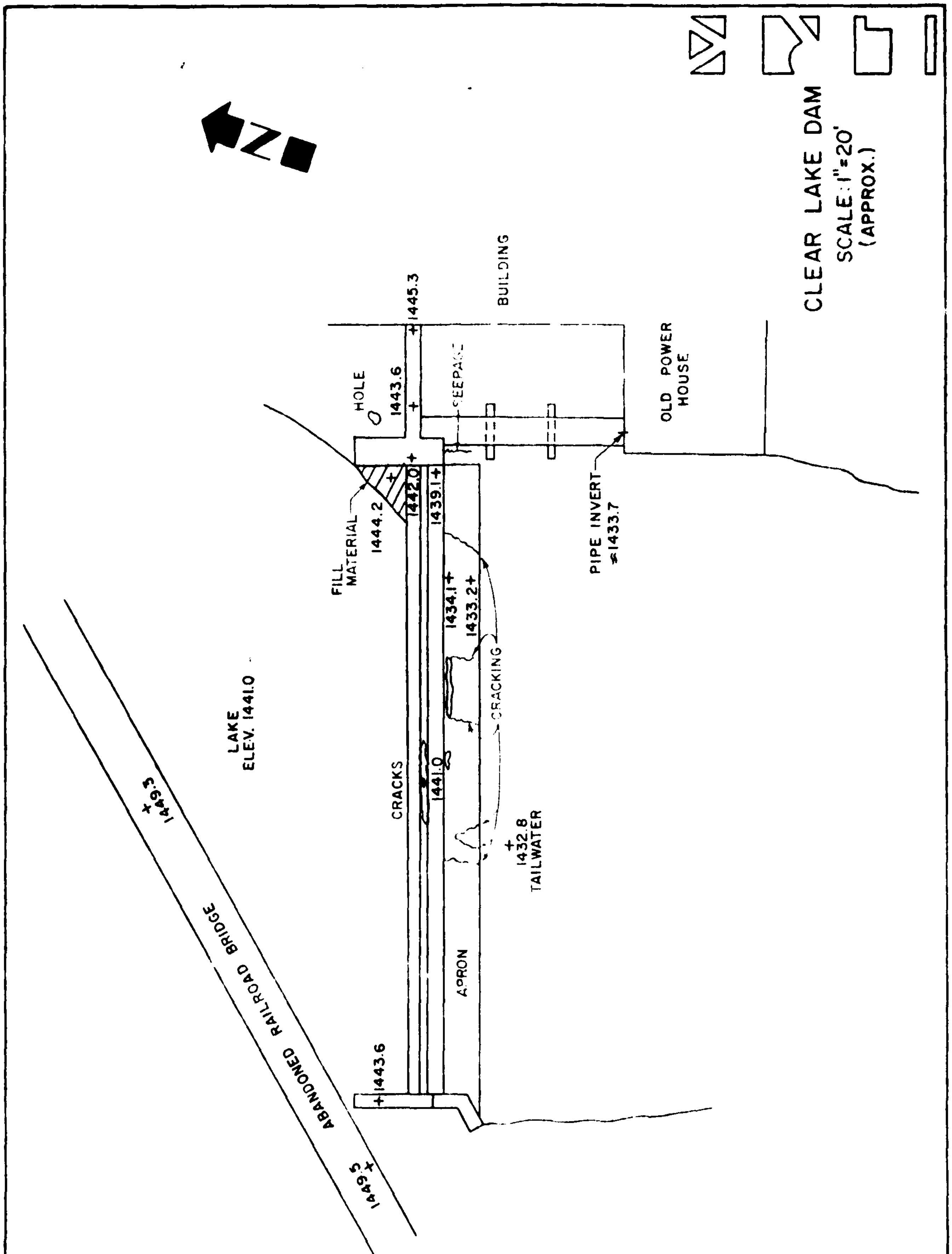
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	A roadway bridge exists several 100 feet below the dam but does not appear as though it would affect discharges from the reservoir. The downstream channel for the Clear Lake Dam is relatively narrow and consists of the East Branch of Oil Creek.	
SLOPES	Appear to be stable.	
APPROXIMATE NO. OF HOMES AND POPULATION	One home - 4 people within 1.2 miles of the dam.	

RESERVOIR

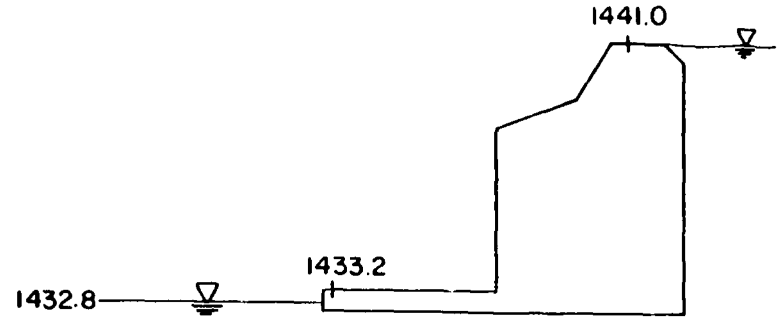
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Gentle to moderate slopes. Appear stable.	
SEDIMENTATION	Exact extent of sedimentation unknown. Visible sedimentation behind the concrete gravity section.	

INSTRUMENTATION

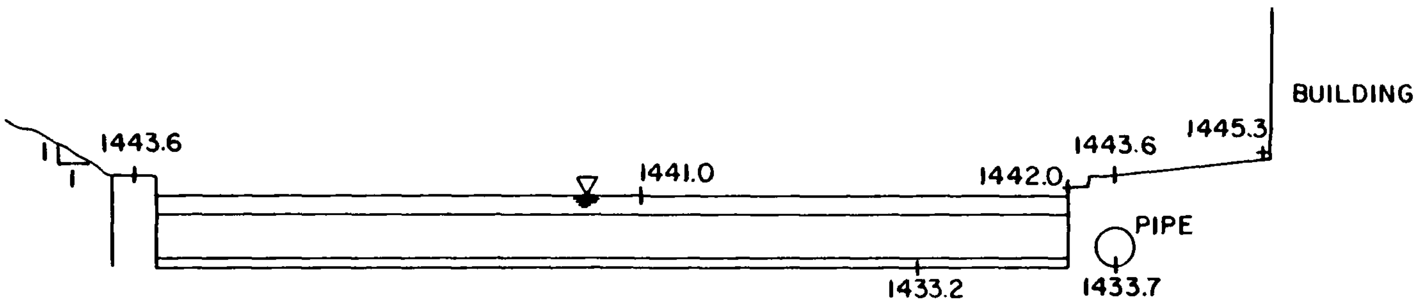
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	None.	



CLEAR LAKE DAM
SCALE: 1"=20'
(APPROX.)
N
BUILDING
OLD POWER HOUSE
1445.3
HOLE
1443.6
SEEPAGE
PIPE INVERT
≈1433.7
FILL MATERIAL
1444.2
1442.0
1439.1
1434.1
1433.2
CRACKING
LAKE
ELEV. 1441.0
CRACKS
1441.0
1432.8
TAILWATER
1449.3
ABANDONED RAILROAD BRIDGE
APRON
1443.6
1449.5



SPILLWAY SECTION
(NOT TO SCALE)



PROFILE
LOOKING UPSTREAM
(SCALE: 1"=20')

CLEAR LAKE DAM

APPENDIX B

CHECKLIST, ENGINEERING DATA, DESIGN, CONSTRUCTION, OPERATION, PHASE I

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Clear Lake Dam

ID# PA 175

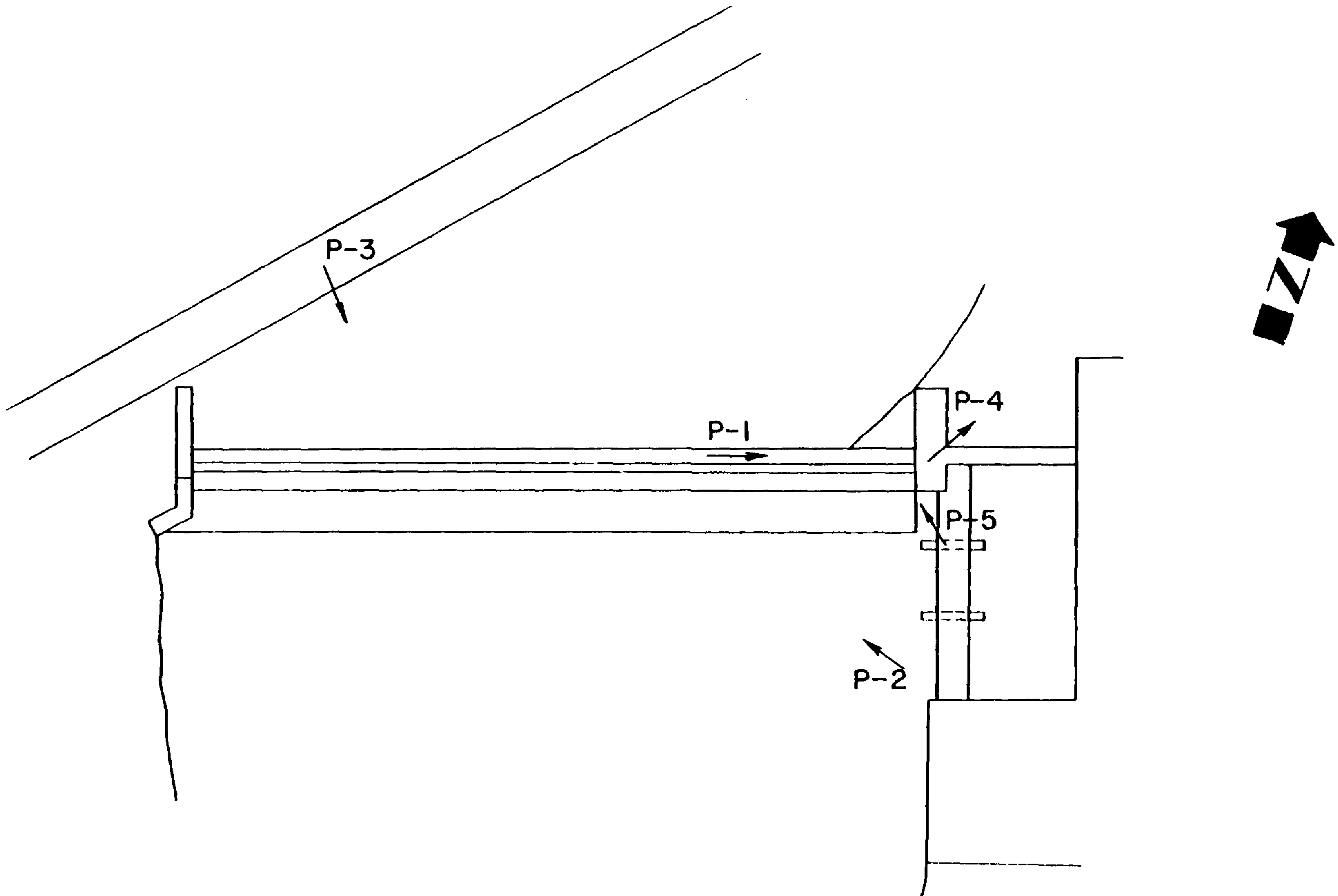
ITEM	REMARKS
AS-BUILT DRAWINGS	None available.
REGIONAL VICINITY MAP	U.S.G.S. 7.5 minute quadrangle.
CONSTRUCTION HISTORY	None available.
TYPICAL SECTIONS OF DAM	None available.
OUTLETS - PLAN	None.
- DETAILS	None.
- CONSTRAINTS	None.
- DISCHARGE RATINGS	None.
RAINFALL/RESERVOIR RECORDS	None.

ITEM	REMARKS
DESIGN REPORTS	Not available for review.
GEOLOGY REPORTS	Unknown.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None known to exist.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Unknown.
POST-CONSTRUCTION SURVEYS OF DAM	None known to exist.
BORROW SOURCES	Unknown.

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	Information contained in the National Inventory of Dam indicates that the dam was rebuilt in 1902. No other information available.
HIGH POOL RECORDS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None known to exist.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	No known failures.
MAINTENANCE OPERATION RECORDS	None.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	None.
OPERATING EQUIPMENT PLANS & DETAILS	None.

APPENDIX C
PHOTOGRAPHS



CLEAR LAKE DAM
PHOTO INDEX

P – INDICATES PHOTO LOCATION

CLEAR LAKE DAM
PA 175

Sheet 1

Front

(1) Partial view of the spillway crest and left abutment. Note the fill which partially blocks the spillway overflow near the left abutment and the deteriorated metal pipe at the toe of the left abutment.
(2) View of the spillway crest, right spillway wingwall and right abutment. Note the abandoned railway tressel.
(3) View of discharge channel beyond the spillway overflow.
(4) Surface hole which connects to a large void on the left abutment. The void is upstream of the concrete wall at the left abutment and in line with the abandoned penstock.

Sheet 2

Back

(5) Seepage exiting from the toe of the vertical wall at the left abutment directly adjacent to the steel pipe.
(6) Downstream exposure.

TOP OF PAGE

1,5	2,6
3	4




APPENDIX D

HYDROLOGY AND HYDRAULICS

APPENDIX D
HYDROLOGY AND HYDRAULICS

Methodology. The dam overtopping and breach analyses were accomplished using the systemized computer program HEC-1 (Dam Safety Investigation), September, 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. A brief description of the methodology used in the analysis is presented below.

1. Precipitation. The Probable Maximum Precipitation (PMP) is derived and determined from regional charts prepared from past rainfall records including "Hydrometeorological Report No. 40" prepared by the U.S. Weather Bureau.

The index rainfall is reduced from 10% to 20% depending on watershed size by utilization of what is termed the HOP Brook adjustment factor. Distribution of the total rainfall is made by the computer program using distribution methods developed by the Corps.

2. Inflow Hydrograph. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for reservoir routing.

The unit hydrograph is developed using the Snyder method. This method requires calculation of several key parameters. The following list gives these parameters their definition and how they were obtained for these analysis.

Parameter	Definition	Where Obtained
Ct	Coefficient representing variations of watershed	From Corps of Engineers*
L	Length of main stream channel miles	From U.S.G.S. 7.5 minute topgraphic
Lca	Length on main stream to centroid of watershed	From U.S.G.S. 7.5 minute topographic
Cp	Peaking coefficient	From Corps of Engineers*
A	Watershed size	From U.S.G.S. 7.5 minute topographic

*Developed by the Corps of Engineers on a regional basis for Pennsylvania.

3. Routing. Reservoir routing is accomplished by using Modified Plus routing techniques where the flood hydrograph is routed through reservoir storage. Hydraulic capacities of the outlet works, spillways and the crest of the dam are used as outlet controls in the routing.

The hydraulic capacity of the outlet works can either be calculated and input or sufficient dimensions input and the program will calculate an elevation discharge relationship.

Storage in the pool area is defined by an area - elevation relationship from which the computer calculates storage. Surface areas are either planimetered from available mapping or U.S.G.S. 7.5 minute series topographic maps or taken from reasonably accurate design data.

4. Dam Overtopping. Using given percentages of the PMF the computer program will calculate the percentage of the PMF which can be controlled by the reservoir and spillway without the dam overtopping.

5. Dam Breach and Downstream Routing. The computer program is equipped to determine the increase in downstream flooding due to failure of the dam caused by overtopping. This is accomplished by routing both the pre-failure peak flow and the peak flow through the breach (calculated by the computer with given input assumptions) at a given point in time and determining the water depth in the downstream channel. Channel cross-sections taken from U.S.G.S. 7.5 minute topographic maps were used in the downstream flood wave routing. Pre and post failure water depths are calculated at locations where cross-sections are input.

HYDROLOGY AND HYDRAULICS ANALYSIS
DATA BASE

NAME OF DAM: Clear Lake Dam

PROBABLE MAXIMUM PRECIPITATION (PMP) = 23.0 inches

STATION	1	2	3
Station Description	Sub-area A	Sub-area B	Sub-area C
Drainage Area (square miles)	5.05	3.67	4.19
Cumulative Drainage Area (square miles)	5.05	8.72	12.91
Adjustment of PMF for Drainage Area (%)(1)			
6 hours		114	
12 hours		125	
24 hours		138	
48 hours		149	
72 hours		N/A	
Snyder Hydrograph Parameters			
Zone (2)		23B	
Cp (3)		0.42	
Ct (3)		1.28	
L (miles) (4)	3.86	2.61	4.05
Lca (miles) (4)	1.82	1.33	1.82
$tp = Ct(LxLca)^{0.3}$ hrs.	2.30	1.86	2.33
Spillway Data			
Crest Length (ft)		102	
Freeboard (ft)		2.6	
Discharge Coefficient		3.3	
Exponent		1.5	

(1) Hydrometeorological Report 33 (Figure 2), U.S. Weather Bureau & U.S. Army Corps of Engineers, 1965.

(2) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's coefficients (C_p and C_t).

(3) Snyder's Coefficients.

(4) L=Length of longest water course from outlet to basin divide. L_{ca}=Length of water course from outlet to point opposite the centroid of drainage area.

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 12.91 sq.m.

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1441.0[393 ac-ft]

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): N/A

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: 1443.6

SPILLWAY CREST:

a. Elevation 1441.0
b. Type Modified broad crest
c. Width 2 feet
d. Length 102 feet
e. Location Spillover Entire section
f. Number and Type of Gates None

OUTLET WORKS:

a. Type None
b. Location None
c. Entrance inverts None
d. Exit inverts None
e. Emergency drawdown facilities None

HYDROMETEOROLOGICAL GAUGES:

a. Type None
b. Location None
c. Records None

MAXIMUM NON-DAMAGING DISCHARGE: Unknown

LOSS RATE AND BASE FLOW PARAMETERS

AS RECOMMENDED BY THE BALTIMORE DISTRICT CORPS OF ENGINEERS.

STRTL = 1 INCH
CNSTL = 0.05 IN/HR.
STRTQ = 1.5 cfs./mi²
QRCSN = 0.05 (5% OF PEAK FLOW)
RTIOR = 2

ELEVATION - AREA - CAPACITY RELATIONSHIP

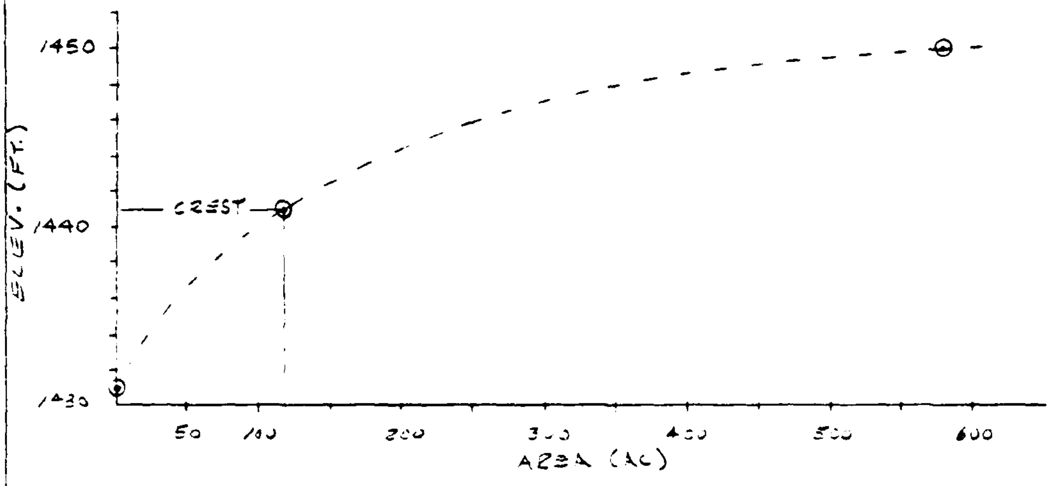
FROM U.S.G.S. 7.5-MIN. QUAD AND FIELD INSPECTION DATA.

SPILLWAY CREST ELEV. = 1441'
AREA AT ELEV. 1441' = 118 ACRES

INITIAL STORAGE:
FROM THE CONIC METHOD FOR RESERVOIR VOLUME. FLOOD HYDROGRAPH PACKAGE (HEC-1) DAM SAFETY VERSION (USER'S MANUAL).

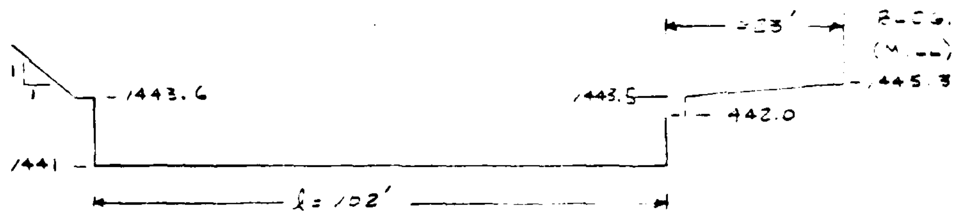
$H = 3V/A$ WHERE H = ESTIMATED DEPTH
$V = AH/3$
$V = (118\ \text{AC.})(10\ \text{FT.})/3$
$V = 393.3$ AC.FT USE 393 AC.FT

AT ELEV. 1445, ESTIMATED AREA = 225 ACRES
AT ELEV. 1450, AREA = 578 ACRES



ELEV. (FT)	1431	1441	1445	1448	1450
AREA (AC)	0	118	225	350	578

DISCHARGE RATING



SPILLWAY CREST
VIEWING UPSTREAM
(NOT TO SCALE)

FROM $Q = CLH^{3/2}$

USE COEFFICIENT OF DISCHARGE (C) = 3.3
USE L = 102' FROM ELEV. 1441' TO 1443.6'

CONSIDER TOP OF DAM = 1443.6
(NON-OVERFLOW SECTION)

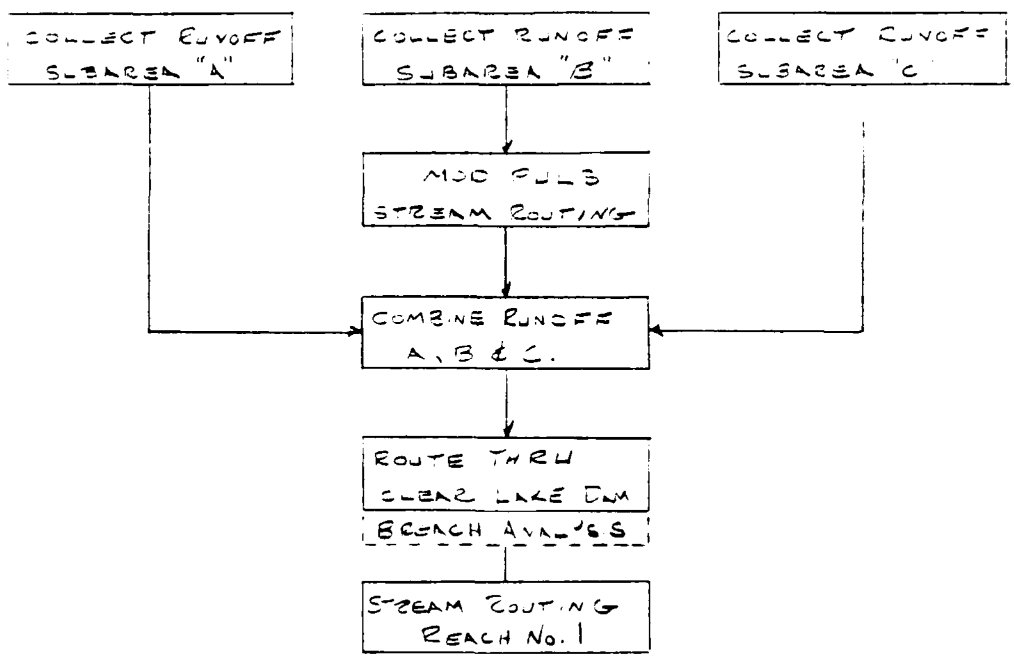
L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

NAME
NUMBER PA-175
SHEET NO. 3 OF
BY [illegible] DATE 12/80

ELEVATION (FT.)	L (FT)	H (FT)	*DISCHARGE (Q) (cfs)
1441	102	0	0
1442	102	1	340
1443	102	2	950
1443.6	102	2.6	1410
1444	≃ 115	3	1970
1445	≃ 130	4	3430
1446	≃ 131	5	4830
1448	≃ 133	7	8130
1450	≃ 135	9	12030

NOTE: FLOWS OVER THE NON-OVERFLOW SECTION INCLUDED IN THE RATING CURVE. DISCHARGE VALUES ROUNDED TO NEAREST 10 cfs.

PROGRAM SCHEDULE



BREACH ANALYSIS

PLAN 1: ASSUME A TOTAL FAILURE OF THE GRAVITY SPILLWAY STRUCTURE DURING A 1/2 PMF EVENT. FAILURE ASSUMED TO OCCUR AS THE POOL ELEVATION REACHES 1449.0 FEET.

BRWID = 102'
Z = 0
ELBM = 1433.2
TFAIL = 0.17 HRS OR 10 MIN.
WSEL = 1441
FAILEL = 1449.0

NOTE: SD CARD, FIELD 4, PAGE D-9. THE 33' VALUE ALLOWS ADDITIONAL DISCHARGE TO BE COMPUTED. THE ADDITIONAL DISCHARGE MAY OCCUR AROUND THE WALL AT THE LEFT ABUTMENT. CONSIDERATION OF THE ADDITIONAL CAPACITY OR THE LACK OF THE CAPACITY WILL NOT CHANGE THE CONCLUSIONS OF THE REPORT.

```
*************************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
  LAST MODIFICATION  01 APR 80
*************************************
          A1        ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
          A2        HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF CLEAR LAKE DAM (PA-175)
          A3        RATIOS OF PMF ROUTED THROUGH THE RESERVOIR
          B      288       0      10       0       0       0       0       0      -4       0
          B1       5
          J        1       4       1
          J1     .05      .1      .5       1
          K        0       1                                       1
          K1        INFLOW SUBAREA A
          M        1       1    5.05                       1
          P             23.0     114     125     138     149
          T                                                      1.0    0.05
          W     2.30    0.42
          X     -1.5    -.05     2.0
          K        0       2                                       1
          K1        INFLOW SUBAREA B
          M        1       1    3.67                       1
          P             23.0     114     125     138     149
          T                                                      1.0    0.05
          W     1.86    0.42
          X     -1.5    -.05     2.0
          K        1       3                                       1
          K1        MOD PULS STREAM ROUTING
          Y                                1       1
          Y1       1
          Y6     .06     .05     .06    1458    1480    3000     .01
          Y7       0    1480     250    1470    1050    1460    1052    1458    1058    1458
          Y7    1060    1460    1400    1470    1700    1480
          K        0       4                                       1
          K1        INFLOW SUBAREA C
          M        1       1    4.19                       1
          P             23.0     112     125     138     149
          T                                                      1.0    0.05
          W     2.33    0.42
          X     -1.5    -.05     2.0
          K        3       5                                       1
          K1        COMBINE INFLOW SUBAREAS A,B & C
          K        1       6                                       1
          K1        ROUTE THRU CLEAR LAKE
          Y                                1       1
          Y1       1                                           -1441      -1
          Y4    1441    1442    1443  1443.6    1444    1445    1446    1448    1450
          Y5       0     340     950    1410    1970    3430    4830    8130   12030
          $A       0     118     225     350     578
          $E    1431    1441    1445    1448    1450
          $$    1441
          $D  1443.6     3.0     1.5      33
          K       99
```

```
**************************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**************************************

RUN  DATE* 81/01/22.
     TIME* 05.08.47.


              ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
              HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF CLEAR LAKE DAM (PA-175)
              RATIOS OF PMF ROUTED THROUGH THE RESERVOIR

                                JOB SPECIFICATION
          NQ     NHR    NMIN    IDAY     IHR    IMIN   METRC    IPLT    IPRT   NSTAN
         288       0      15       0       0       0       0       0      -4       0
                         JOPER     NWT   LROPT   TRACE
                             5       0       0       0

                         MULTI-PLAN ANALYSES TO BE PERFORMED
                           NPLAN= 1 NRTIO= 4 LRTIO= 1
         RTIOS=    .05     .10     .50    1.00


   **********        **********        **********        **********        **********

                              SUB-AREA RUNOFF COMPUTATION

          INFLOW SUBAREA A

                  ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                      1       0       0       1       0       0       1       0       0

                                      HYDROGRAPH DATA
         IHYDG   IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
             1      1    5.05    0.00    5.05    1.00   0.000       0       0       0

                                       PRECIP DATA
                SPFE     PMS      R6     R12     R24     R48     R72     R96
                0.00   23.00  114.00  125.00  138.00  149.00    0.00    0.00

                                        LOSS DATA
       LROPT  STRKR  DLTKR  RTIOL  ERAIN  STRKS  RTIOK  STRTL  CNSTL  ALSMX  RTIMP
           0   0.00   0.00   1.00   0.00   0.00   1.00   1.00    .05   0.00   0.00

                                  UNIT HYDROGRAPH DATA
```

TP= 2.30 CP= .42 NTA= 0

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH100 END-OF-PERIOD ORDINATES, LAG= 2.30 HOURS, CP= .42 VOL= .98

16.	40.	82.	133.	190.	253.	319.	387.	449.	503.
547.	581.	603.	612.	601.	578.	554.	532.	510.	490.
470.	451.	432.	415.	398.	382.	366.	351.	337.	323.
310.	298.	286.	274.	263.	252.	242.	232.	223.	214.

205.	197.	189.	181.	174.	167.	160.	153.	147.	141.
135.	130.	125.	120.	115.	110.	106.	101.	97.	93.
89.	86.	82.	79.	76.	73.	70.	67.	64.	62.
59.	57.	54.	52.	50.	48.	46.	44.	42.	41.
39.	37.	36.	34.	33.	32.	30.	29.	28.	27.
26.	25.	24.	23.	22.	21.	20.	19.	19.	18.

0
END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	34.27	31.77	2.50	519450.
										(870.)(	807.)(	64.)(	14709.19)

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW SUBAREA B

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	3.67	0.00	3.67	1.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.00	114.00	125.00	138.00	149.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 1.86 CP= .42 NTA= 0

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH100 END-OF-PERIOD ORDINATES, LAG= 1.88 HOURS, CP= .42 VOL= .99

13.	48.	97.	159.	227.	300.	373.	436.	487.	524.
546.	546.	526.	499.	476.	450.	427.	406.	386.	366.
348.	330.	314.	298.	283.	269.	255.	242.	230.	218.
207.	197.	187.	178.	169.	160.	152.	145.	137.	130.
124.	118.	112.	106.	101.	96.	91.	86.	82.	78.
74.	70.	67.	63.	60.	57.	54.	51.	49.	46.

5

44.	42.	40.	38.	36.	34.	32.	31.	29.	28.
26.	25.	24.	23.	21.	20.	19.	18.	17.	17.
16.	15.	14.	13.	13.	12.	12.	11.	10.	10.
9.	9.	9.	8.	8.	7.	7.	7.	6.	6.

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	34.27	31.77	2.50	403205.

(870.)(807.)(64.)(11417.49)

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

MOD PULS STREAM ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0
	NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
	1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0600	.0500	.0600	1458.0	1480.0	3000.	.01000

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 1480.00 250.00 1470.00 1050.00 1460.00 1052.00 1458.00 1058.00 1458.00
1060.00 1460.00 1400.00 1470.00 1700.00 1480.00

STORAGE	0.00	.57	1.71	10.64	30.10	60.08	100.59	151.63	213.19
777285.28									
	367.90	459.94	557.42	659.97	767.61	880.32	998.11	1120.98	1248.93
771381.96									
OUTFLOW	0.00	22.91	83.63	425.58	1474.77	3557.78	6952.79	11910.24	18661.52
727423.79									
	38402.95	52816.32	70207.48	89780.88	112160.40	136778.32	163872.80	193496.12	225663.61
265452.81									
STAGE	1458.00	1459.16	1460.32	1461.47	1462.63	1463.79	1464.95	1466.11	1467.26
771468.42									
	1469.58	1470.74	1471.89	1473.05	1474.21	1475.37	1476.53	1477.68	1478.84
771480.00									
FLOW	0.00	22.91	83.63	425.58	1474.77	3557.78	6952.77	11910.25	18661.52

7

```
227423.79
         38402.95    52916.32    70207.48    89980.88   112160.40   136778.32   163872.80   193486.12   225663.61
260452.81

MAXIMUM STAGE IS     1461.5

MAXIMUM STAGE IS     1462.1

MAXIMUM STAGE IS     1464.2

MAXIMUM STAGE IS     1465.6

         **********          **********          **********          **********          **********

                               SUB-AREA RUNOFF COMPUTATION
```

INFLOW SUBAREA C

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	4.19	0.00	4.19	1.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.00	112.00	125.00	138.00	149.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 2.33 CP= .42 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH100 END-OF-PERIOD ORDINATES, LAG= 2.34 HOURS, CP= .42 VOL= .98

8.	32.	66.	107.	153.	204.	258.	313.	364.	408.
445.	473.	493.	502.	496.	478.	458.	440.	422.	405.
389.	374.	359.	344.	330.	317.	304.	292.	280.	269.
258.	248.	238.	228.	219.	210.	202.	194.	186.	179.
171.	165.	158.	152.	145.	140.	134.	129.	123.	119.
114.	109.	105.	101.	97.	93.	89.	85.	82.	79.
76.	72.	70.	67.	64.	62.	59.	57.	54.	52.
50.	48.	46.	44.	43.	41.	39.	38.	36.	35.
33.	32.	31.	29.	28.	27.	26.	25.	24.	23.
22.	21.	20.	20.	19.	18.	17.	17.	16.	15.

0

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

SUM 34.27 31.76 2.51 430111.
(870.)(807.)(64.)(12179.39)

*********** *********** *********** *********** ***********

COMBINE HYDROGRAPHS

COMBINE INFLOW SUBAREAS A,B & C

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
5	1	0	0	0	0	1	0	0

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE THRU CLEAR LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
6	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1441.	-1

STAGE	1441.00	1442.00	1443.00	1443.60	1444.00	1445.00	1446.00	1448.00	1450.00
FLOW	0.00	340.00	950.00	1410.00	1970.00	3430.00	4830.00	8130.00	12030.00

SURFACE AREA=	0.	118.	225.	350.	578.
CAPACITY=	0.	393.	1068.	1924.	2842.
ELEVATION=	1431.	1441.	1445.	1448.	1450.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1441.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1443.6	3.3	1.5	33.

PEAK OUTFLOW IS 1088. AT TIME 44.53 HOURS

PEAK OUTFLOW IS 7518. AT TIME 43.83 HOURS

PEAK OUTFLOW IS 12402. AT TIME 43.83 HOURS

PEAK OUTFLOW IS 21433. AT TIME 44.57 HOURS

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 .05	RATIO 2 .10	RATIO 3 .50	RATIO 4 1.00
				RATIOS APPLIED TO FLOWS			
HYDROGRAPH AT	1	5.05	1	590.	1180.	5899.	11798.
	(	13.08)	(	16.70)(	33.41)(	167.04)(	334.08)(
HYDROGRAPH AT	2	3.67	1	487.	973.	4866.	9732.
	(	9.51)	(	13.78)(	27.56)(	137.80)(	275.59)(
ROUTED TO	3	3.67	1	481.	964.	4845.	9704.
	(	9.51)	(	13.63)(	27.29)(	137.20)(	274.78)(
HYDROGRAPH AT	4	4.19	1	480.	960.	4802.	9604.
	(	10.85)	(	13.60)(	27.20)(	135.98)(	271.96)(
3 COMBINED	5	12.91	1	1550.	3101.	15504.	31001.
	(	33.44)	(	43.90)(	87.81)(	439.01)(	877.84)(
ROUTED TO	6	12.91	1	1088.	2518.	12402.	21433.
	(	33.44)	(	30.82)(	71.29)(	351.18)(	606.92)(

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.05	481.	1461.5	41.83
.10	964.	1462.1	41.83
.50	4845.	1464.2	41.67
1.00	9704.	1465.6	41.67

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1441.00	1441.00	1443.60
STORAGE	393.	393.	782.
OUTFLOW	0.	0.	1410.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.05	1443.18	0.00	708.	1088.	0.00	44.50	0.00
.10	1444.33	.73	924.	2518.	6.50	43.83	0.00
.50	1449.41	5.81	2522.	17402.	10.17	43.83	0.00
1.00	1453.17	9.57	5393.	21433.	14.17	44.50	0.00

```
************************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION        JULY 1978
LAST MODIFICATION    01 APR 80
************************************
A1     RATIOS OF PMF ROUTED THROUGH THE RESERVOIR AND DOWNSTREAM
A2     DOWNSTREAM CONDITIONS DUE TO DAM FAILURE (CLEAR LAKE DAM PA-175)
A3     PLAN 1 ASSUMES BREACH, PLAN 2 ASSUMES NO BREACH
B    288      0     10      0      0      0      0      0     -4      0
B1     5
J      2      1      1
J1    .5
K      0      1                                    1
K1     INFLOW SUBAREA A
M      1      1   5.05                  1                            1
P          23.0    114    125    138    149
T                                              1.0   0.05
W   2.30   0.42
X   -1.5   -.05    2.0
K      0      2                                    1
K1     INFLOW SUBAREA B
M      1      1   3.67                  1                            1
P          23.0    114    125    138    149
T                                              1.0   0.05
W   1.86   0.42
X   -1.5   -.05    2.0
K      1      3                                    1
K1     MOD PULS STREAM ROUTING
Y                          1      1
Y1     1
Y6   .06    .05    .06   1458   1480   3000    .01
Y7     0   1480    250   1470   1050   1460   1052   1458   1058   1458
Y7  1060   1460   1400   1470   1700   1480
K      0      4                                    1
K1     INFLOW SUBAREA C
M      1      1   4.17                  1                            1
P          23.0    112    125    138    149
T                                              1.0   0.05
W   1.33   0.42
X   -1.5   -.05    2.0
K      5      5                                    1
K1     COMBINE INFLOW SUBAREAS A, B & C
K      1      6                                    1
K1     ROUTE THRU CLEAR LAKE
Y                          1      1
Y1     1                                   -1441     -1
Y4  1441   1442   [illegible]   [illegible]   [illegible]   1445   1446   1448   1450
Y5     [illegible]   [illegible]   [illegible]   [illegible]   [illegible]   4430   4430   [illegible]   [illegible]
SA     0    113   [illegible]   [illegible]   [illegible]
SE  [illegible]   1441   [illegible]   [illegible]   [illegible]
$$  1441
$D  1441   [illegible]   [illegible]
$L  [illegible]   [illegible]   [illegible]   [illegible]   1441   [illegible]
$V  [illegible]   [illegible]   [illegible]   [illegible]
```

F1	REACH NO 1									
Y					1	1				
Y1	1									
Y6	.05	.06	.05	1399	1420	6500	.005			
Y7	0	1420	100	1410	700	1400	702	1399	722	1399
Y7	724	1400	900	1410	1075	1420				
F	99									

****
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 01 APR 80
****

RUN DATE* 81/01/22.
TIME* 06.08.37.

RATIOS OF PMF ROUTED THROUGH THE RESERVOIR AND DOWNSTREAM
DOWNSTREAM CONDITIONS DUE TO DAM FAILURE (CLEAR LAKE DAM PA-175)
PLAN 1 ASSUMES BREACH, PLAN 2 ASSUMES NO BREACH

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	0	10	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 2 NRTIO= 1 LRTIO= 1

RTIOS= .50

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW SUBAREA A

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	[illegible]	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	5.95	0.00	5.95	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.00	114.00	125.00	136.00	149.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
[illegible]	0.00	[illegible]	1.	[illegible]	[illegible]	1.	1.[illegible]	.05	[illegible]	0.00

UNIT HYDROGRAPH DATA

TP= 2.30 CP= .42 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 100 END-OF-PERIOD ORDINATES, LAG= 2.30 HOURS, CP= .42 VOL= .98

15.	40.	82.	133.	190.	253.	319.	387.	449.	503.
547.	581.	603.	612.	601.	578.	554.	532.	510.	490.
470.	451.	432.	415.	398.	382.	366.	351.	337.	323.
310.	298.	286.	274.	263.	252.	242.	232.	223.	214.

205.	197.	[illegible]	181.	174.	167.	160.	153.	147.	141.
135.	130.	125.	120.	115.	110.	106.	101.	97.	93.
89.	86.	82.	79.	76.	73.	70.	67.	64.	62.
59.	57.	54.	52.	50.	48.	46.	44.	42.	41.
39.	37.	36.	34.	33.	32.	[illegible]	29.	28.	27.
26.	25.	24.	23.	22.	21.	20.	[illegible]	19.	18.

END-OF-PERIOD FLOW

0 MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	34.27	31.77	2.50	519450.
										(870.)(	807.)(	64.)(	14709.19)

**********   **********   **********   **********   **********

SUB-AREA RUNOFF COMPUTATION

INFLOW SUBAREA B

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	3.67	0.00	3.67	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.00	114.00	125.00	138.00	149.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 1.86   CP= .42   NTA= 0

RECESSION DATA

STRTQ= -1.50   QRCSN= -.05   RTIOR= 2.00

UNIT HYDROGRAPH100 END-OF-PERIOD ORDINATES, LAG= 1.88 HOURS, CP= .42 VOL= .99

13.	48.	99.	159.	227.	300.	373.	436.	487.	524.
547.	546.	526.	499.	474.	450.	427.	407.	386.	376.
348.	330.	314.	298.	283.	269.	255.	[illegible]	230.	218.
207.	197.	187.	178.	169.	160.	152.	145.	137.	130.
124.	118.	112.	106.	101.	96.	91.	86.	82.	78.
74.	70.	67.	[illegible]	60.	57.	54.	51.	49.	46.

17

44.	42.	40.	38.	36.	34.	32.	31.	29.	28.
26.	25.	24.	23.	21.	20.	19.	18.	17.	17.
16.	15.	14.	13.	13.	12.	12.	11.	10.	10.
9.	9.	8.	8.	8.	7.	7.	7.	6.	6.

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	34.27	31.77	2.50	403205.

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                                                                        870.1( 807.)(  64.)(11417.49)

          **********        **********        **********        **********        **********

                                         HYDROGRAPH ROUTING

                MOD PULS STREAM ROUTING

                        ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                            3       1       0       0       0       0       1       0       0

                                          ALL PLANS HAVE SAME
                                             ROUTING DATA
                QLOSS   CLOSS     AVG    IRES   ISAME    IOPT    IPMP            LSTR
                  0.0   0.000    0.00       1       1       0       0               0

                        NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA  ISPRAT
                            1       0       0   0.000   0.000   0.000      0.       0

NORMAL DEPTH CHANNEL ROUTING
----------------------------

     QN(1)   QN(2)   QN(3)   ELNVT   ELMAX    RLNTH     SEL
     .0600   .0500   .0600  1458.0  1480.0    3000.  .01000

     CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
         0.00 1480.00  250.00 1470.00 1050.00 1460.00 1057.00 1458.00 1058.00 1458.00
      1060.00 1460.00 1400.00 1470.00 1700.00 1480.00

STORAGE        0.00       .57      1.71     10.64     30.10     60.08    100.59    151.63    213.19
 ///285.28
             367.90    459.94    557.42    659.97    767.61    880.32    998.11   1120.98   1248.93
 ///1381.96

OUTFLOW        0.00     22.91     83.63    425.58   1474.77   3557.78   6952.79  11910.24  18661.52
 ///27473.79
           38402.95  52816.32  70207.48  89980.88 112160.40 136778.32 163872.80 193486.12 225663.61
 ///260452.61

  STAGE     1458.00   1459.16   1460.32   1461.47   1462.63   1463.79   1464.95   1466.11   1467.26
 ///1468.42
            1469.58   1470.74   1471.89   1473.05   1474.21   1475.37   1476.53   1477.68   1478.84
 ///1480.00
```

19

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     FLOW        0.00       22.91       33.63      425.58     1474.77     3557.78     6952.79    11910.24    18661.52
227423.79
             38402.95    52816.32    70207.48    90780.88   111160.40   136778.32   163872.80   193486.12   225663.61
268452.81

MAXIMUM STAGE IS    1464.2

MAXIMUM STAGE IS    1464.2


         **********        **********        **********        **********        **********

                                 SUB-AREA RUNOFF COMPUTATION

                   INFLOW SUBAREA C
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           ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                       0       0       0       0       0       1       0       0

                                      HYDROGRAPH DATA
   IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
       1       1    4.19    0.00    4.19    1.00   0.000       0       1       0

                                      PRECIP DATA
            SPFE     PMS      R6     R12     R24     R48     R72     R96
            0.00   23.00  112.00  125.00  138.00  149.00    0.00    0.00

                                      LOSS DATA
   LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
       0    0.00    0.00    1.00    0.00    0.00    1.00    1.00     .05    0.00    0.00

                                      UNIT HYDROGRAPH DATA
                          TP=  2.33     CP= .42     NTA=  0

                                      RECESSION DATA
                 STRTQ=   -1.50     QRCSN=    -.05     RTIOR= 2.00

   UNIT HYDROGRAPH100 END-OF-PERIOD ORDINATES, LAG=  2.34 HOURS, CP= .42   VOL=  .98
        6.      32.      66.     107.     153.     204.     258.     313.     364.     408.
      445.     473.     493.     502.     496.     478.     458.     440.     422.     405.
      389.     374.     359.     344.     330.     317.     304.     292.     280.     269.
      258.     248.     238.     228.     219.     210.     202.     194.     186.     179.
      171.     165.     158.     152.     145.     140.     134.     129.     123.     119.
      114.     109.     105.     101.      97.      93.      89.      85.      82.      79.
       76.      72.      70.      67.      64.      62.      59.      57.      54.      52.
       50.      48.      46.      44.      43.      41.      39.      38.      36.      35.
       33.      32.      31.      29.      28.      27.      26.      25.      24.      23.
       22.      21.      20.      20.      19.      18.      17.      17.      16.      15.

0                                     END-OF-PERIOD FLOW
MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q      MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q

                                                        SUM  34.27  31.76   2.51  430111.
                                                           ( 870.)( 807.)( 64.)(12179.39)

**********     **********     **********     **********     **********

                                 COMBINE HYDROGRAPHS

       COMBINE INFLOW HYDROGRAPHS

           ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                                       0       0       0       1       0       0
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**********   **********   **********   **********   **********

HYDROGRAPH ROUTING

ROUTE THRU CLEAR LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO

0 1 0 0 0 0 1 0 0

ALL PLANS HAVE SAME
ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1441.	-1

STAGE	1441.00	1442.00	1443.00	1443.60	1444.00	1445.00	1446.00	1448.00	1450.00
FLOW	0.00	340.00	950.00	1410.00	1970.00	3430.00	4830.00	8130.00	12030.00

SURFACE AREA=	0.	118.	225.	350.	578.
CAPACITY=	0.	393.	1068.	1924.	2842.
ELEVATION=	1431.	1441.	1445.	1448.	1450.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1441.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1443.6	3.3	1.5	33.

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
102.	0.00	1433.20	.17	1441.00	1449.00

BEGIN DAM FAILURE AT 42.67 HOURS

PEAK OUTFLOW IS 37752. AT TIME 42.84 HOURS

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
102.	0.00	1433.20	.17	1441.00	1460.00

PEAK OUTFLOW IS [illegible]. AT TIME 43.93 HOURS

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

REACH [illegible] 1

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
7	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME
ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT

1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0500	.0700	.0500	1399.0	1420.0	6500.	.00500

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 1420.00 100.00 1410.00 700.00 1400.00 702.00 1399.00 722.00 1399.00
724.00 1400.00 900.00 1410.00 1075.00 1420.00

STORAGE	0.00	3.72	16.10	42.63	83.30	138.11	207.07	290.18	387.43
260498.82	624.36	759.04	898.74	1043.45	1193.18	1347.92	1507.67	1672.43	1842.21
262017.00									
OUTFLOW	0.00	43.26	232.06	777.30	1848.10	3587.06	6122.25	9571.89	14046.86
71765.27	26542.55	35798.95	46317.39	58083.92	71091.87	85339.70	100829.63	117566.71	135558.18
154813.00									
STAGE	1399.00	1400.11	1401.21	1402.32	1403.42	1404.53	1405.63	1406.74	1407.84
261408.95	1410.05	1411.16	1412.26	1413.37	1414.47	1415.58	1416.68	1417.79	1418.89
261420.00									
FLOW	0.00	43.26	232.06	777.30	1848.10	3587.06	6122.25	9571.89	14046.86
117657.27	26542.55	35798.95	46317.39	58083.92	71091.87	85339.70	100829.63	117566.71	135558.18
154813.00									

MAXIMUM STAGE IS 1409.9

MAXIMUM STAGE IS 1407.4

....

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
[illegible]

OPERATION	STATION	AREA	PLAN	RATIO 1 .50
HYDROGRAPH AT	1	5.05	1	[illegible]
		(13.08)		([illegible])
			2	[illegible]
				([illegible])
HYDROGRAPH AT	2	3.67	1	4866.
		(9.51)		(137.[illegible])
			2	4866.
				(137.[illegible])
ROUTED TO	3	3.67	1	4845.
		(9.51)		(137.20)(
			2	4845.
				(137.20)(
HYDROGRAPH AT	4	4.19	1	4802.
		(10.85)		(135.98)(
			2	4802.
				(135.98)(
3 COMBINED	5	12.91	1	15504.
		(33.44)		(439.01)(
			2	15504.
				(439.01)(
ROUTED TO	6	12.91	1	30236.
		(33.44)		(856.19)(
			2	12402.
				(351.18)(
ROUTED TO	7	12.91	1	25847.
		(33.44)		(731.91)(
			2	12366.
				(350.15)(

RATIOS APPLIED TO FLOWS

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	4845.	1464.2	41.67

PLAN 2 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	4845.	1464.2	41.67

27/27

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1441.00	1441.00	1443.60
STORAGE	393.	393.	782.
OUTFLOW	0.	0.	1410.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1449.08	5.48	2363.	30352.	7.33	42.84	42.67

PLAN 2 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1441.00	1441.00	1443.60
STORAGE	393.	393.	782.
OUTFLOW	0.	0.	1410.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1449.41	5.81	2522.	12402.	10.17	43.83	0.00

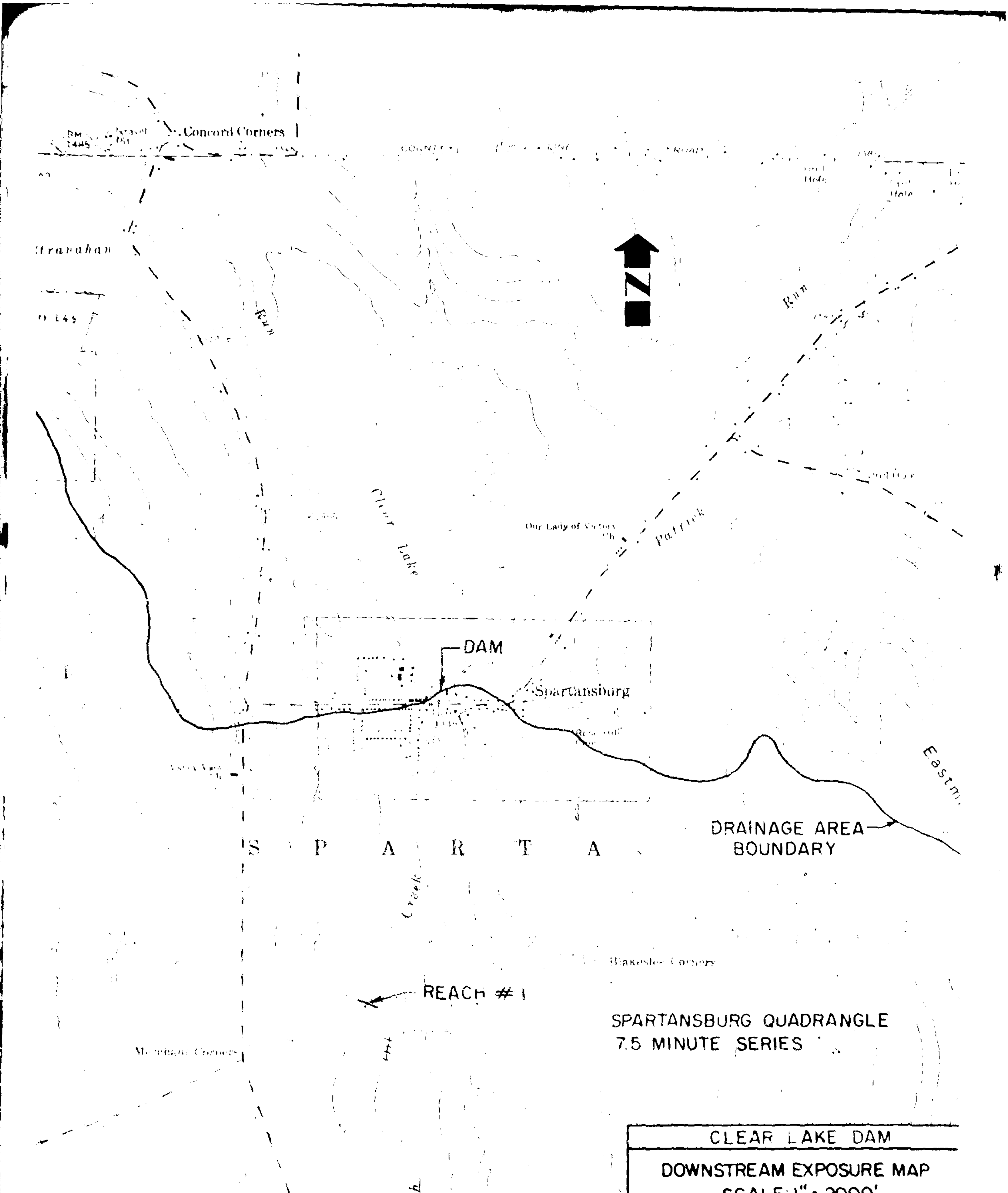
PLAN 1 STATION 1

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	25847.	1409.9	43.33

PLAN 2 STATION 1

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	12366.	1407.4	44.17

APPENDIX E
DRAWINGS

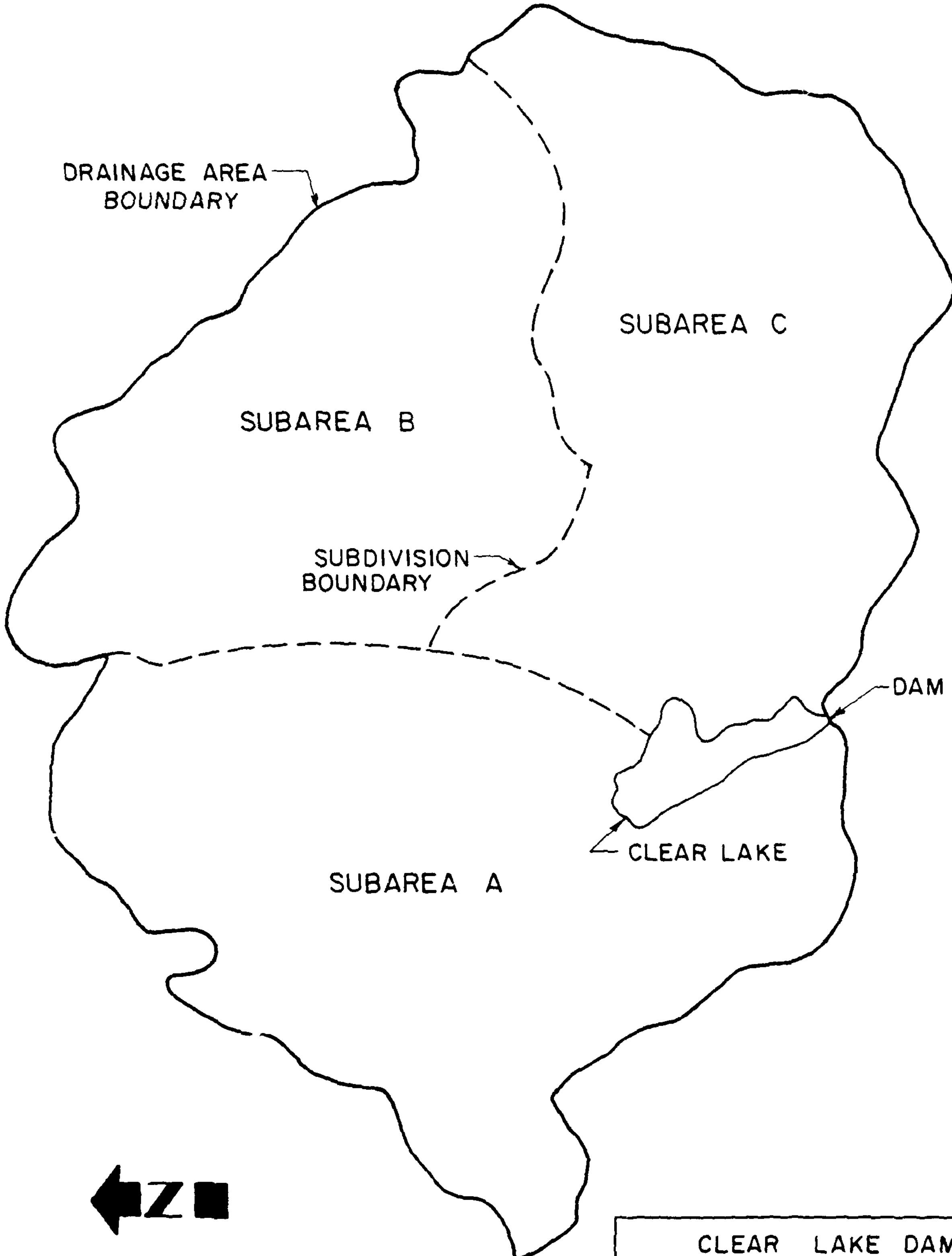


CLEAR LAKE DAM

DOWNSTREAM EXPOSURE MAP

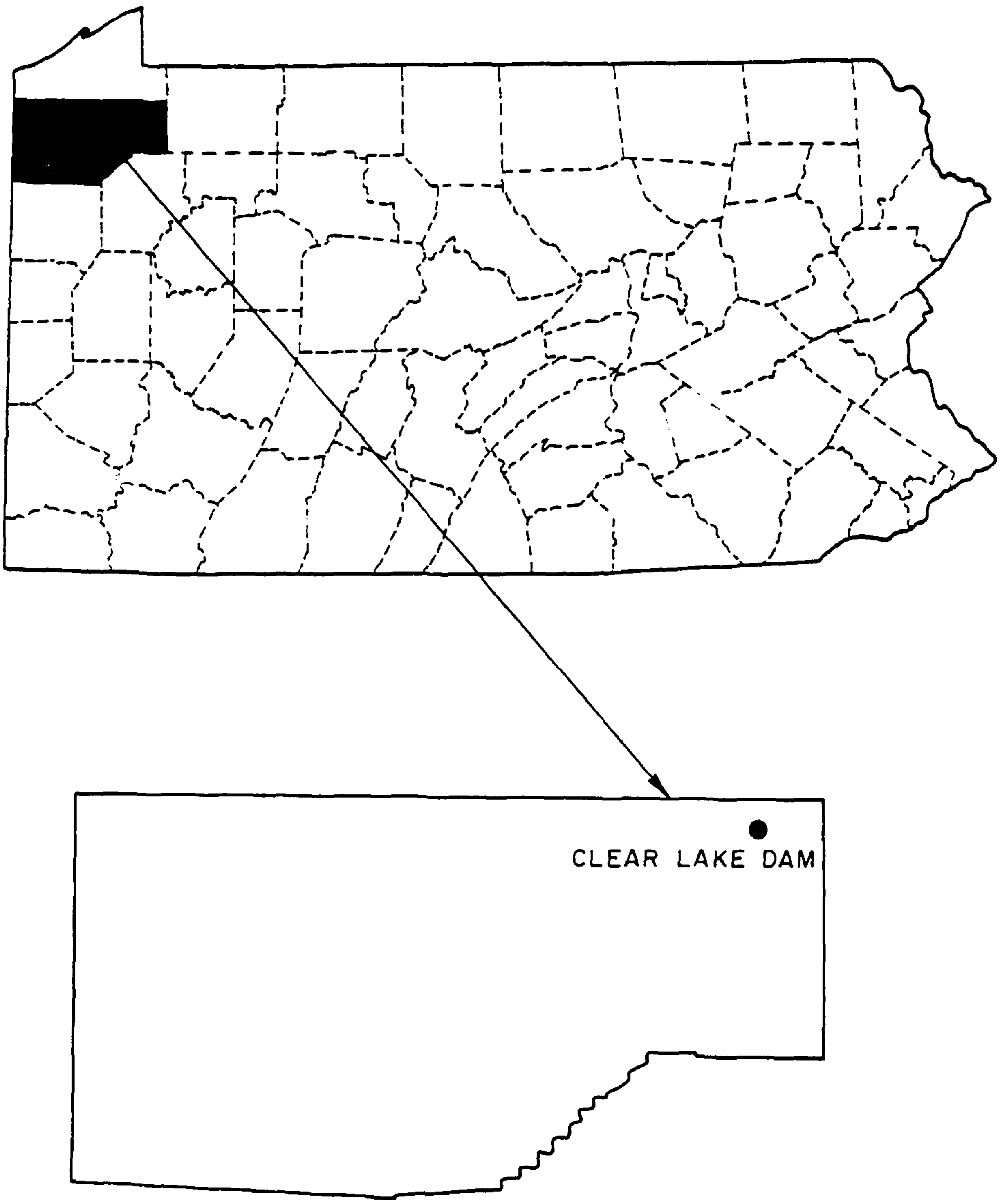
SCALE: 1" = 2000'

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS



CLEAR LAKE DAM

DRAINAGE AREA MAP
SCALE: 1" 3200'



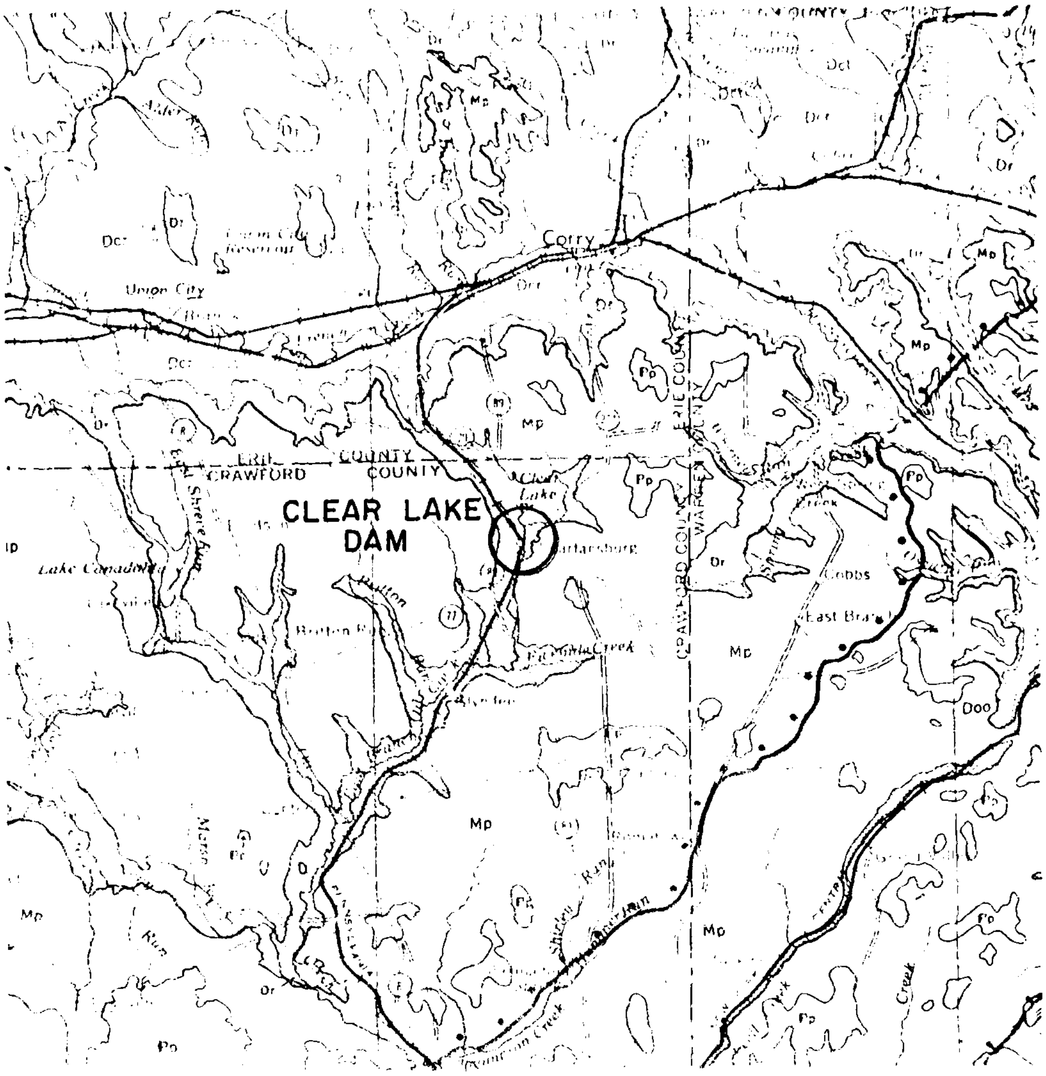
SITE LOCATION MAP
CRAWFORD COUNTY, PENNSYLVANIA

APPENDIX F
GEOLOGY

General Geology

The Clear Lake Dam is located in the Glaciated Section of the Appalachian Plateaus Province. This section is an area where the advancing and retreating ice sheets of Pleistocene time deposited drift, both in the valleys and on the uplands. The drift is generally composed of clay, sand, and gravel, though in some places the drift is a dense ipervious till. The sand and gravel of the glacial drift are the largest producers of groundwater in this area.

The dam is underlain by Upper Devonian Age rocks of the Riceville Formation. This unit consists of mostly shale, with siltstones and sandstones. The rocks generall appear to be horizontal, though there is a slight regional dip to the south of less than one degree. Irregularities in the dip do exist, but are ususally slight. There is no major faulting indicated in the vicinity of Clear Lake Dam.



GEOLOGIC MAP OF AREA AROUND CLEAR LAKE DAM
SCALE 1:250,000

QUATERNARY

PLEISTOCENE

EASTERN PENNSYLVANIA

Border of Wisconsin drift

DEVONIAN

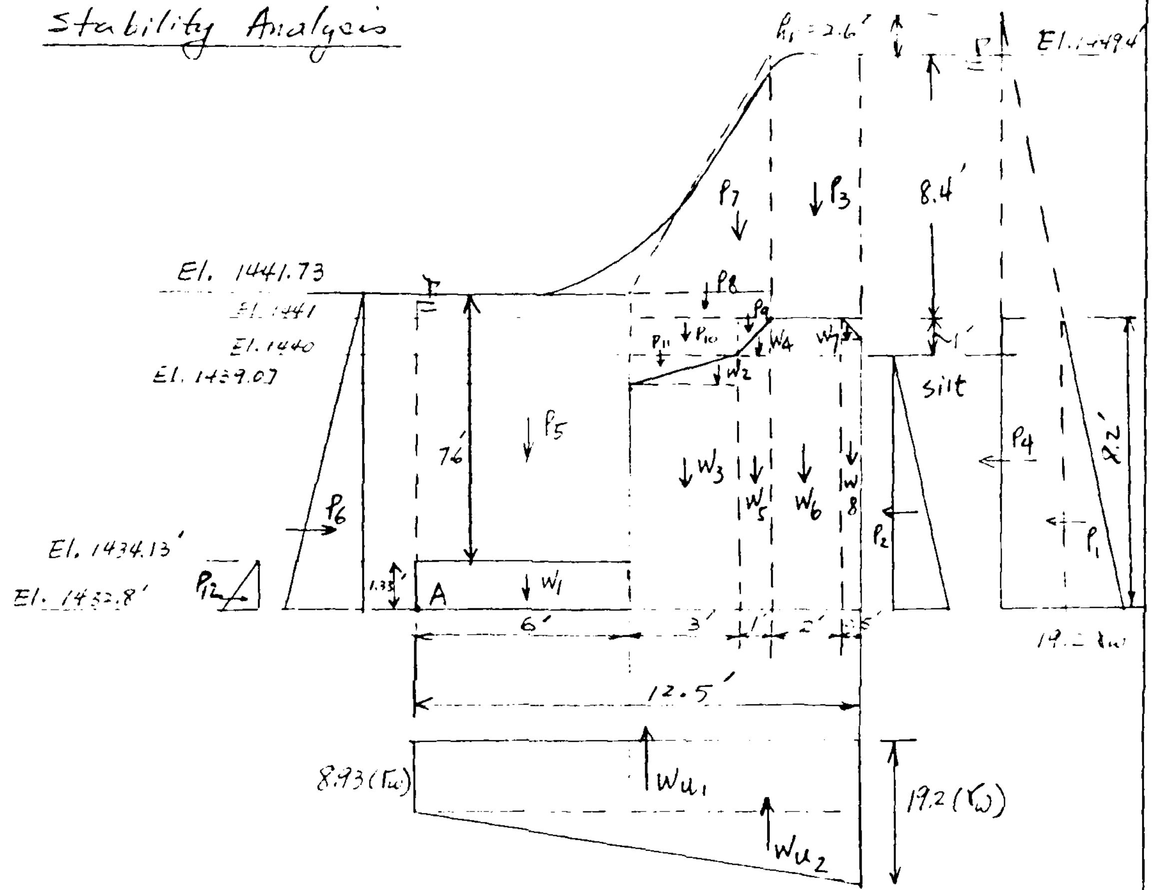
WESTERN PENNSYLVANIA

APPENDIX G
STABILITY ANALYSIS

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

NAME Clear lake
NUMBER
SHEET NO. 1 OF 5
BY TS DATE

Stability Analysis



Assumptions:

1 Unit weight of Saturated silt = 120 pcf.

2 Angle of internal friction for silt = 30°

3 Coefficient of friction between concrete & gravel = 0.5

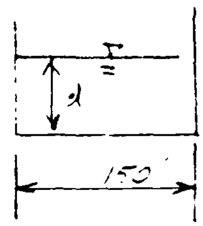
4. Concrete : 150 pcf

5. Tailwater level at El 1441.73

Downstream channel is assumed rectangular-shaped

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

NAME [illegible]
NUMBER
SHEET NO. 2 OF [illegible]
BY [illegible] DATE



$Q = 12400$ cfs (From HEC 2)
$S = 0.005$

From Manning's Formula

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$$12400 = \frac{1.49}{n}(150d)\left[\frac{150d}{150+2d}\right]^{2/3}(0.005)^{1/2}$$

Use $n = 0.035$
Trial & error $d = 7.6'$

$12400 = 12437.6$

$Q = AV$ [illegible]

$12400 = (7.6)(150)V$ $V =$ [illegible]

$h_v =$ [illegible] $= 2.60$ ft

Water Pressure

$P_1 = (\frac{1}{2})(62.4)(8.2)^2 = 2097.89$ #

$P_3 = (7.5)(8.4)(62.4) = 1310.4$ #

$P_4 = (7.6 + 2.6)(62.4)(8.2) =$ [illegible] #

$P_5 =$ [illegible] $(62.4) =$ [illegible] #

$P_6 =$ [illegible] $= 2422.$[illegible] #

$P_7 =$ [illegible] #

$P_8 =$ [illegible] $(62.4) = 172.$[illegible] #

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CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

NAME ______
NUMBER ______
SHEET NO. [illegible] OF [illegible]
BY ______ DATE ______

$P_9 =$ [illegible] $= 212$ #

$P_{10} =$ [illegible] $=$ [illegible] #

$P_{11} =$ [illegible] $=$ [illegible] #

[illegible] $=$ [illegible] #

Silt Pressure

$P =$ [illegible] $=$ [illegible] #

$P =$ [illegible] $=$ [illegible] #

[illegible]

$W_1 =$ [illegible] $= 1197$ lb

$W_2 =$ [illegible] $=$ [illegible] #

$W_3 =$ [illegible] $=$ [illegible] #

$W_4 =$ [illegible] $=$ [illegible] #

$W_5 = (72)(1)(150) = 1080$ #

$W_6 =$ [illegible] $=$ [illegible] #

$W_7 =$ [illegible] $=$ [illegible] #

$W_8 =$ [illegible] $=$ [illegible] #

total $=$ [illegible] #

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

NAME
NUMBER
SHEET NO. 2 OF 5
BY DATE

[illegible] Pressure

$W_y = W_{1} - W_{2}$

$= (8.73)(62.4)(10.0) + ([illegible])$

$= 69[illegible] + [illegible]$

$= 10970.7\ \#$

Stability Against Sliding

$$F_S = \frac{([illegible])}{[illegible].66 + 2097.89 + [illegible]}$$

$S_{slip} = (2069.12)(0.7) + [illegible] + [illegible] / 822.03$

$$= \frac{417.38}{822.03} = 0.51 < 5$$

Stability Against Overturning (at pt A)

Overturning Moment $= (552.42)[illegible] + [illegible]$

$+ [illegible] - (1053)(8.22)$

$= 23570.[illegible] + 5727.24 + 174.38 + [illegible]$

$+ 33364.15 = 106896.29\ ft\text{-}\#$

Resisting Moment $= (1210.4)(11.35) + [illegible]$

$+ (209[illegible])(3) + (282.5)[illegible] + [illegible]$

$+ (246[illegible])(11) + (12[illegible])(13.6) + [illegible]$

$+ (822.0)(2) + [illegible] + [illegible] + [illegible]$

$+ (2845.[illegible])(7) + (1422.4)(\frac{8.22}{3}) + [illegible]$

NAME

NUMBER

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

SHEET NO. 5 OF 5

BY ______ DATE ______

$= $ [illegible]

$+ $ [illegible]

$= 113946.00$ ft-lb

$FS_{\text{rotation}} = 1.07 < 1.5$

$\Sigma V = 30672.02$ #

$$e = \frac{[illegible] - 113946.00}{30672} = [illegible]$$

[illegible] $> 23'$

[illegible] resultant [illegible] middle third of the base.

DATE
ILMED
-8